Results from the September 2015 *CCGS* *Neocaligus* Shrimp Trawl Survey in Chatham Sound British Columbia with Emphasis on Eulachon (*Thaleichthys pacificus*)

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RESULTS FROM THE SEPTEMBER 2015 *CCGS Neocaligus* SHRIMP TRAWL SURVEY IN CHATHAM SOUND BRITISH COLUMBIA WITH EMPHASIS ON EULACHON (*Thaleichthys pacificus*)

by

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ABSTRACT

MacConnachie, S., Fong, K., and Therriault, T.W. 2016. Results from the September 2015 *CCGS Neocaligus* shrimp trawl survey in Chatham Sound British Columbia with emphasis on Eulachon (*Thaleichthys pacificus*) Can. Manuscr. Rep. Fish. Aquat. Sci. 3095: v + 21 p.

Multi-species surveys are fundamental fisheries assessment tools that can be used to inform a number of Fisheries and Oceans Canada (DFO) objectives including stock assessment and species at risk questions. A shrimp survey was conducted in Chatham Sound (PFMA 3 and 4) from September 13-18, 2015 primarily to inform shrimp stock assessment in the Prince Rupert District (PRD). Nass/Skeena Eulachon have been assessed by COSEWIC as a species of special concern and the Eulachon Technical Committee of the Skeena Area Marine Research Collaboration group identified the need for additional Eulachon data. Thus, biological sampling of Eulachon was conducted during the survey, including tissue sampling to be used to genetically determine stock composition. Eulachon were observed in all 42 tows and comprised 12.48% of the cumulative catch by weight. A bi-modal length-frequency distribution confirms two dominant Eulachon age classes were present in Chatham Sound. Microsatellite analysis indicates that 45.6% of the fish sampled originated from the Nass/Skeena system with 45.6% representing Eulachon from Central Coast populations. Continued monitoring of Eulachon dynamics in this area is important to inform the recovery potential of this at-risk species.

RÉSUMÉ

MacConnachie, S., Fong, K., et Therriault, T.W. 2015. Résultats du relevé de pêche à la crevette au chalut de septembre 2015 du *NGCC Neocaligus* effectué dans le détroit de Chatham (Colombie-Britannique), avec l'accent mis sur l'eulakane (*Thaleichthys pacificus*) Rapp. manus. can. sci. halieut. aquat. 3095: v + 21 p.

Les relevés plurispécifiques sont des outils d'évaluation des pêches essentiels qui peuvent servir à façonner un certain nombre d'objectifs de Pêches et Océans Canada (MPO), y compris l'évaluation des stocks et les questions liées aux espèces en péril. Un relevé sur la crevette a été mené entre le 13 et le 18 septembre 2015 dans les secteurs 3 et 4 du détroit de Chatham, principalement pour éclairer l'évaluation du stock de crevettes dans le district de Prince Rupert. L'eulakane des rivières Nass et Skeena a été désigné comme étant une espèce préoccupante par le COSEPAC, et le comité technique de l'eulakane du groupe collaboration en recherche dans la zone marine de Skeena a confirmé la nécessité de recueillir d'avantage de données sur l'eulakane. Par conséquent, l'échantillonnage biologique de l'eulakane a été mené pendant le relevé, y compris l'échantillonnage de tissus destinés à être utilisés pour déterminer génétiquement la composition du stock. L'eulakane était présent dans chacun des 42 coups de filet et a constitué 12,48 % du poids des prises totales. Une distribution bimodale des fréquences des longueurs confirme que deux classes d'âge dominantes de l'eulakane étaient présentes dans le détroit de Chatham. Une analyse microsatellite indique que 45,6 % des poissons échantillonnés provenaient du système des rivières Nass et Skeena, dont une proportion de 45,6 % était composée d'eulakane provenant des populations de la côte centrale. La surveillance continue de la dynamique des populations d'eulakane dans cette zone joue un rôle important dans l'évaluation du potentiel de rétablissement de cette espèce en péril.

INTRODUCTION

Chatham Sound is a productive northern Pacific ecosystem supporting a diversity of fisheries including Pink Shrimp (*Pandalus sp.)* and Sidestripe Shrimp (*Pandalopsis dispar*) fisheries. In addition, this area is home to several at-risk species including Eulachon (*Thaleichthys pacificus*). The Nass/Skeena designatable unit (population) of Eulachon were assessed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC 2013). The species as a whole has experienced dramatic declines across its entire range and interest has been raised by stakeholders, community groups and First Nations to focus efforts on population recovery and increase the understanding of life history parameters and population dynamics.

One such organisation is the Skeena Area Marine Research Collaboration group (SAMRC) who are interested in better understanding the impacts from different activities on different taxa in the Skeena River, estuary and neashore waters *via* enhanced collaboration. Eulachon are one of the species that SAMRC has identified as a priority for further investigation as they are not only culturally important to local First Nations but play an important trophic role as a key prey resource for numerous species. SAMRC has established an Eulachon Technical Committee to identify and prioritize collaborative research initiatives.

In 1998, Fisheries and Oceans Canada established a number of assessment surveys to index abundance of inshore shrimp stocks throughout the coast of British Columbia, including Chatham Sound (Boutillier et al. 1999a; 1999b). Concurrent with shrimp catch, Eulachon are regularly intercepted. Unfortunately, due to resource constraints and changing priorities, detailed biological data on Eulachon had not been collected on the Chatham Sound survey since 2004. Working collectively, the Eulachon Technical Committee identified the need to re-establish Eulachon data collection and sought funding to provide a technician to participate in the survey, collect biological information and tissue samples for subsequent genetic analysis.

METHODS

An area-swept shrimp trawl survey was undertaken in Chatham Sound from September 13-18, 2015. The Canadian Coast Guard ship (CCGS) *Neocaligus* was used to complete the survey, which covered portions of Pacific Fisheries Management Areas (PFMA) 3-02, 4-05, 4-09, and 4-12 following methods outlined in Boutillier et al. (1999a,b). The *Neocaligus* was fitted with a 17.7 m high rise otter trawl and 1.8 m Thyboron trawl doors. The net included a Nordmore separator grate (a fish exclusion device) to emulate the behaviour of the commercial shrimp trawl fishery.

Catch processing consisted of sorting and weighing the catch by species, with sub-sampling as required based on total catch weight. Tow locations were predetermined using a fixed-station design (Figure 1) and were limited to 20 minutes in duration.

Total catch was weighed by species to the nearest 0.01 kg except when sub-sampling was required in which case the random sub-sample was processed in lieu of the total catch. The species-specific catch weights were then extrapolated by applying the species ratio in the sub-sample to the total weight of the catch. Species weighing less than 0.01 kg were recorded as 'trace'. Specimens were identified to the lowest taxonomic level where possible

If there were sufficient Eulachon in the tow, 50 fish would be measured for fork length. A total sample weight was taken and mean weight per fish was calculated. Unfortunately individual weights were not collected due to logistical limitations. In addition, the first five Eulachon measured had a tissue sample collected for genetic analysis. Over the course of the survey 200 whole Eulachon were collected to allow for further histological or other analyses. All samples retained were delivered frozen to the Pacific Biological Station (PBS) in Nanaimo, British Columbia.

Catch per unit effort (CPUE) was calculated by dividing the catch of Eulachon in kilograms by the tow time (20 minutes) and then multiplied by 60 to convert into hours.

Tissue samples for stock composition analysis were collected from 210 mature Eulachon and preserved on Whatman paper. The DNA was extracted from the samples by using a variety of methods: a chelex resin protocol (Small et al. 1998), a Qiagen 96-well DNeasy procedure, or a Promega Wizard SV96 Genomic DNA Purification System. Subsequently, PCR amplifications were conducted for 14 microsatellite loci as described in Withler et al (2000) and Beacham et al. (2005). The PCR fragments were size fractionated by using an ABI 3730 capillary DNA sequencer (Applied Biosystems, Inc. [ABI], Foster City, California. Genotypes were scored with ABI GeneMapper version 3.0. Stock ID was performed using cBayes (Neaves et al. 2005). The program estimates the stock composition in the mixtures by using the method of Pella and Masuda (2001), which employs an informative prior for genetic characters derived from baseline samples to subsequently generate posterior distributions for the stock proportions in the mixtures.

RESULTS

In total 89 different species were encountered during the survey. Sidestripe Shrimp (*Pandalopsis dispar*) was the dominant species totaling 967.09 kg or 30.18% of the total catch (Table 1). Combined Pink Shrimp (*Pandalus borealis* and *Pandalus jordani*) catch totalled 922.01 kg or 28.77%, while Eulachon (*T. pacificicus*) catch totalled 399.92 kg or 12.48% of the total catch (Table 1). Forty two tows were completed during the survey, all of which had Eulachon (Table 2). Eulachon catch was variable ranging from <1kg to 69kg per tow. Relative catch and locations can be seen in Figure 1. Length-frequency analysis of Eulachon showed a distinctly bimodal size distribution suggesting two cohorts, most likely age-1+ and age-2+ fish based on length (Figure 2). A similar pattern can be seen in Figure 4 that shows the length-frequency of the 200 fish that were collected and returned to PBS.

From the genetic analysis, 45.6 % of the sampled fish were deemed to originate from the Nass/Skeena systems and 45.6% from the Central Coast with the remainder from either the Columbia River or the Fraser River (Table 3). Appendix 1 has the population assignments by sample.

Table 1. Cumulative catch and species composition.

Common name	Scientific name	Total catch (kg)	Percent of Total Catch
Sidestripe Shrimp	*Pandalopsis dispar*	967.09	30.18
Pink Shrimp (Spiny)	*Pandalus borealis*	581.61	18.15
Eulachon	*Thaleichthys pacificus*	399.92	12.48
Pink Shrimp (Smooth)	*Pandalus jordani*	340.40	10.62
Blackbelly Eelpout	*Lycodes pacificus*	339.66	10.60
Euphausiids	Euphausiacea	121.94	3.81
Flathead Sole	*Hippoglossoides elassodon*	73.18	2.28
Spotted Ratfish	*Hydrolagus colliei*	70.93	2.21
Shortfin Eelpout	*Lycodes brevipes*	39.05	1.22
Salps	Thaliacea	35.03	1.09
Slender Sole	*Lyopsetta exilis*	31.54	0.98
Eelpouts	Zoarcidae	31.30	0.98
Walleye Pollock	*Theragra chalcogramma*	29.44	0.92
Common Two-Spined Crangon	*Neocrangon communis*	22.19	0.69
Arrowtooth Flounder	*Reinhardtius stomias*	21.90	0.68
Rex Sole	*Glyptocephalus zachirus*	15.98	0.50
Prawn	*Pandalus platyceros*	9.02	0.28
Sea Whip	*Balticina septentrionalis*	9.00	0.28
Shiner Perch	*Cymatogaster aggregata*	7.29	0.23
Wattled Eelpout	*Lycodes palearis*	6.90	0.22
Glass Shrimp	*Pasiphaea pacifica*	6.02	0.19
Pacific Herring	*Clupea pallasii*	5.01	0.16
Northern Crangon	*Crangon alaskensis*	4.84	0.15
Sculpins	Cottidae	4.64	0.14
Sablefish	*Anoplopoma fimbria*	3.87	0.12
Humpback Shrimp	*Pandalus hypsinotus*	3.09	0.10
English Sole	*Parophrys vetulus*	2.37	0.07
Dover Sole	*Microstomus pacificus*	1.81	0.06
Octopus	Octopoda	1.81	0.06
Slender Bladed Shrimp	*Spirontocaris holmesi*	1.46	0.05
Barbed Eualid	*Eualus barbatus*	1.35	0.04
Sponges	Porifera	1.19	0.04
Pacific Tomcod	*Microgadus proximus*	1.14	0.04
Pacific Bobtail Squid	*Rossia pacifica*	1.05	0.03
Smoothskin Octopus	*Benthoctopus leioderma*	1.02	0.03
Schoolmaster Gonate Squid	*Berryteuthis magister*	0.96	0.03
Whitebarred Prickleback	*Poroclinus rothrocki*	0.94	0.03
Heart Urchins	Atelostomata	0.85	0.03
Jellyfish	Scyphozoa	0.80	0.02

Common name	Scientific name	Total catch (kg)	Percent of Total Catch
North Pacific Spiny Dogfish	*Squalus suckleyi*	0.73	0.02
Opalescent Inshore Squid	*Doryteuthis opalescens*	0.65	0.02
Speckled Sanddab	*Citharichthys stigmaeus*	0.55	0.02
Longnose Skate	*Raja rhina*	0.45	0.01
Pacific Cod	*Gadus macrocephalus*	0.45	0.01
Short Scaled Eualid	*Eualus suckleyi*	0.39	0.01
Snake Prickleback	*Lumpenus sagitta*	0.32	0.01
Isopods	Isopoda	0.28	0.01
Rougheye Rockfish	*Sebastes aleutianus*	0.27	0.01
Roughback Sculpin	*Chitonotus pugetensis*	0.21	0.01
Beaked Eualid	*Eualus avinus*	0.20	0.01
Threadfin Sculpin	*Icelinus filamentosus*	0.19	0.01
Daubed Shanny	*Leptoclinus maculatus*	0.18	0.01
Greenstriped Rockfish	*Sebastes elongatus*	0.16	0.00
Sharpchin Rockfish	*Sebastes zacentrus*	0.16	0.00
California Armina	*Armina californica*	0.13	0.00
Darkfin Sculpin	*Malacocottus zonurus*	0.13	0.00
Northern Smoothtongue	*Leuroglossus schmidti*	0.13	0.00
Spinyhead Sculpin	*Dasycottus setiger*	0.13	0.00
Pacific Ocean Perch	*Sebastes alutus*	0.12	0.00
Sturgeon Poacher	*Podothecus accipenserinus*	0.10	0.00
Northern Lampfish	*Stenobrachius leucopsarus*	0.09	0.00
Pacific Lamprey	*Lampetra tridentata*	0.08	0.00
Darkblotched Rockfish	*Sebastes crameri*	0.07	0.00
Slim Sculpin	*Radulinus asprellus*	0.05	0.00
Dana's Bladed Shrimp	*Spirontocaris lamellicornis*	0.05	0.00
Pacific Sergestid	*Sergestes similis*	0.04	0.00
Brittle Stars	Ophiuroidea	0.03	0.00
Redclaw Crab	*Chorilia longipes*	0.03	0.00
Squid	*Gonatus sp.*	0.03	0.00
Yellowleg Shrimp	*Pandalus tridens*	0.03	0.00
Bluespot Shrimp	*Pandalus stenolepis*	0.02	0.00
Pink Shrimp (Flexed)	*Pandalus goniurus*	0.02	0.00
Sand Star	*Luidia foliolata*	0.02	0.00
Spike Shrimp (Horned Shrimp)	*Paracrangon echinata*	0.02	0.00
Berkeleys' Eualid	*Eualus berkeleyorum*	0.01	0.00
Branchiopods	Branchiopoda	0.01	0.00
Coonstripe Shrimp	*Pandalus danae*	0.01	0.00
Gastropods	Gastropoda	0.01	0.00
Longsnout Prickleback	*Lumpenella longirostris*	0.01	0.00
Night Smelt	*Spirinchus starksi*	0.01	0.00
Northern Kelp Crab	*Pugettia producta*	0.01	0.00
Pacific Viperfish	*Chauliodus macouni*	0.01	0.00
Pallid Eelpout	*Lycodapus mandibularis*	0.01	0.00
Proboscis Worm	Nemertea	0.01	0.00
Splitnose Rockfish	*Sebastes diploproa*	0.01	0.00

Common name	Scientific name	Total catch (kg)	Percent of Total Catch
Squat Lobster	*Munida quadrispina*	0.01	0.00
Tadpole Sculpin	*Psychrolutes paradoxus*	0.01	0.00
Tadpole Snailfish	*Nectoliparis pelagicus*	0.01	0.00
Three-Spined Coastal Shrimp	*Heptacarpus tridens*	0.01	0.00

Table 2. Eulachon catch weight and total catch weight by tow.

Tow Number	Eulachon Catch (kg)	Total Catch (kg)
1	60.0	402.0
2	1.0	380.3
3	4.9	60.5
4	1.9	213.9
5	3.1	25.5
6	6.2	42.5
7	3.0	45.7
8	69.5	158.9
9	1.6	51.7
10	14.0	49.7
11	3.9	38.9
12	1.3	59.9
13	10.1	33.9
14	4.7	52.6
15	56.4	96.6
16	7.8	35.0
17	0.4	33.6
18	12.9	62.2
19	10.3	91.1
20	3.7	75.8
21	10.0	65.6
22	5.3	27.2
23	5.4	63.8
24	12.1	75.5
25	10.1	70.0
26	4.5	22.4
27	2.3	46.4
28	3.6	59.7
29	2.7	65.5
30	9.0	63.9
31	1.5	31.9
32	1.0	31.3
33	4.3	66.9
34	16.9	93.4
35	1.5	44.6
36	0.0	25.0
37	7.3	73.0
38	15.7	71.2
39	5.1	46.9
40	0.6	24.6
41	0.8	29.9
42	3.4	95.3

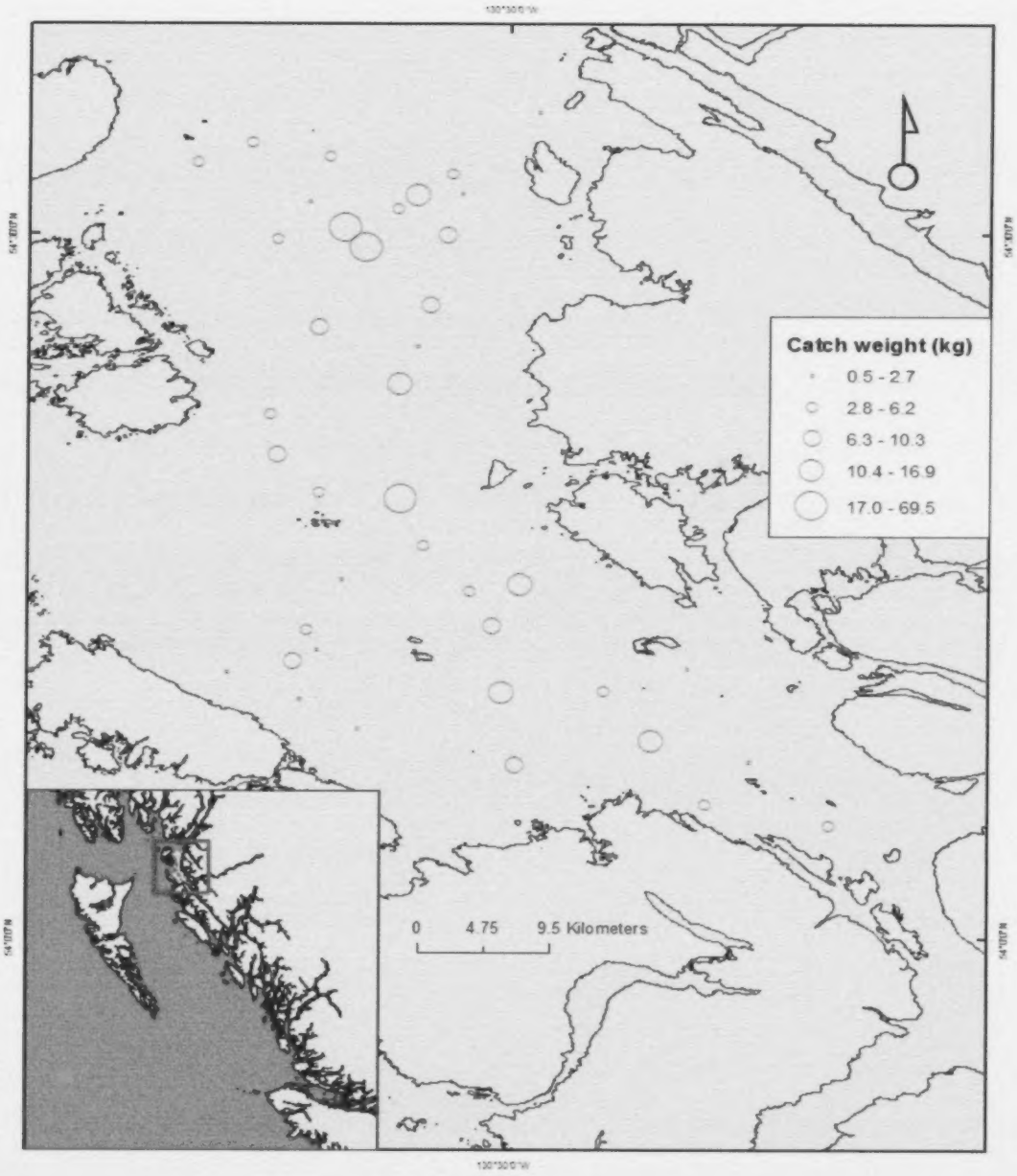

Figure 1. Survey location and relative Eulachon catch by tow.

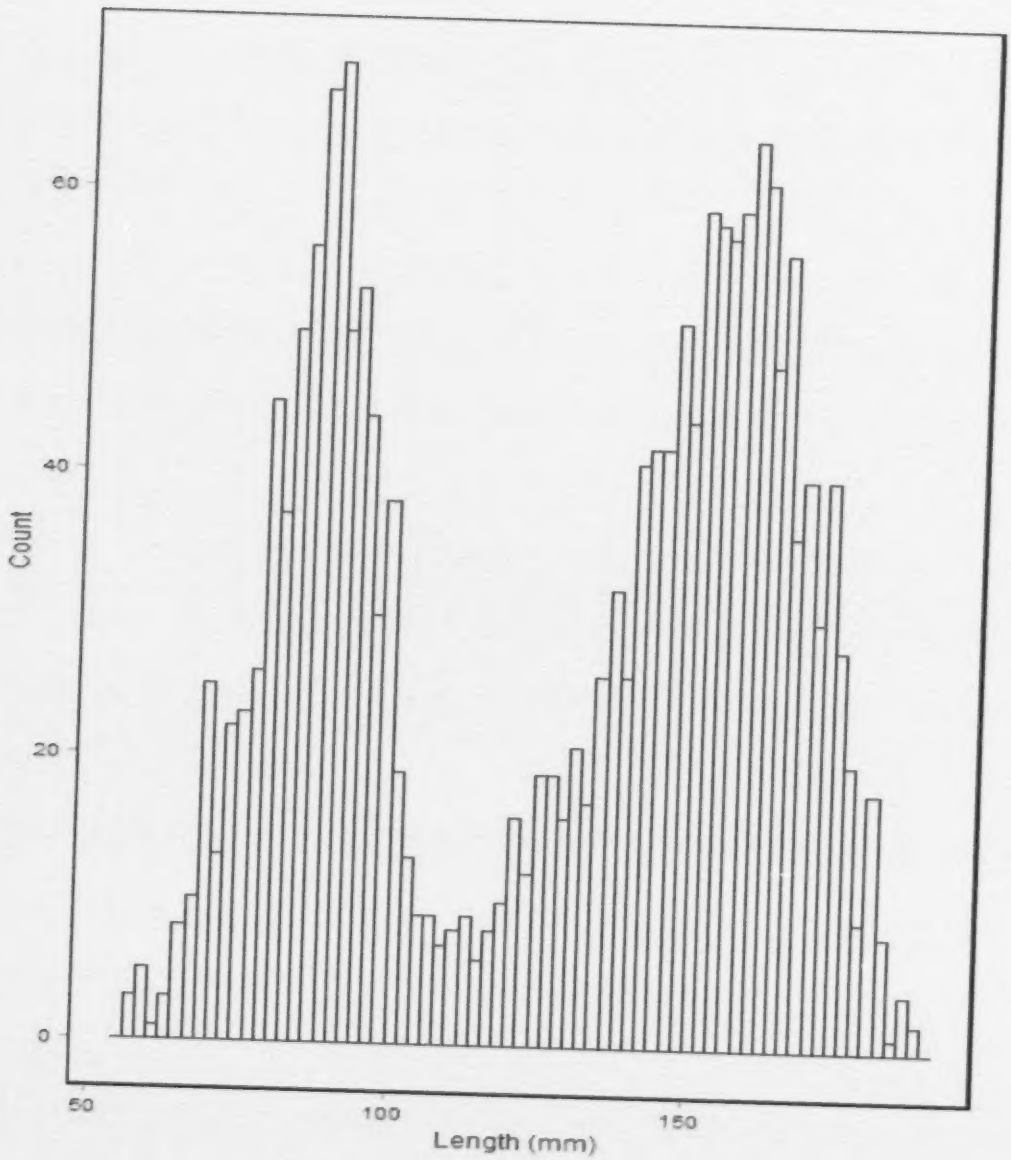

Figure 2. Length-frequency distribution of Eulachon from the 2015 Chatham Sound shrimp survey.

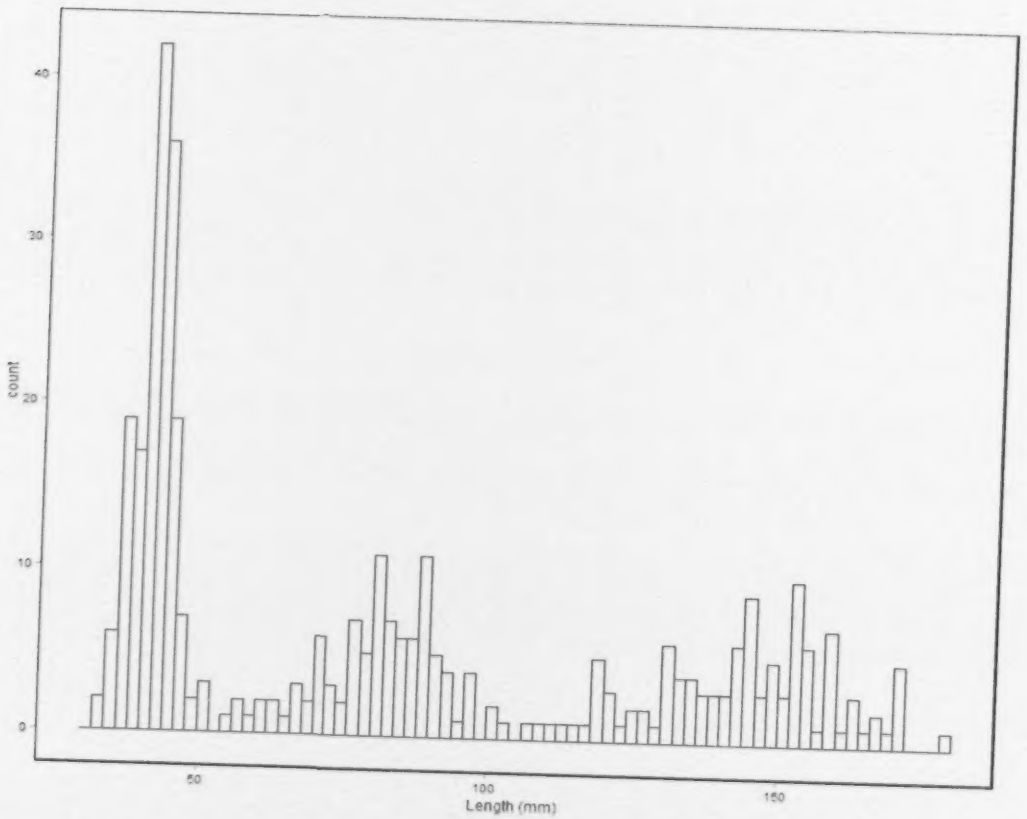

Figure 3. Length-frequency plot of 200 Eulachon collected in Chatham Sound in 2015 and returned to PBS.

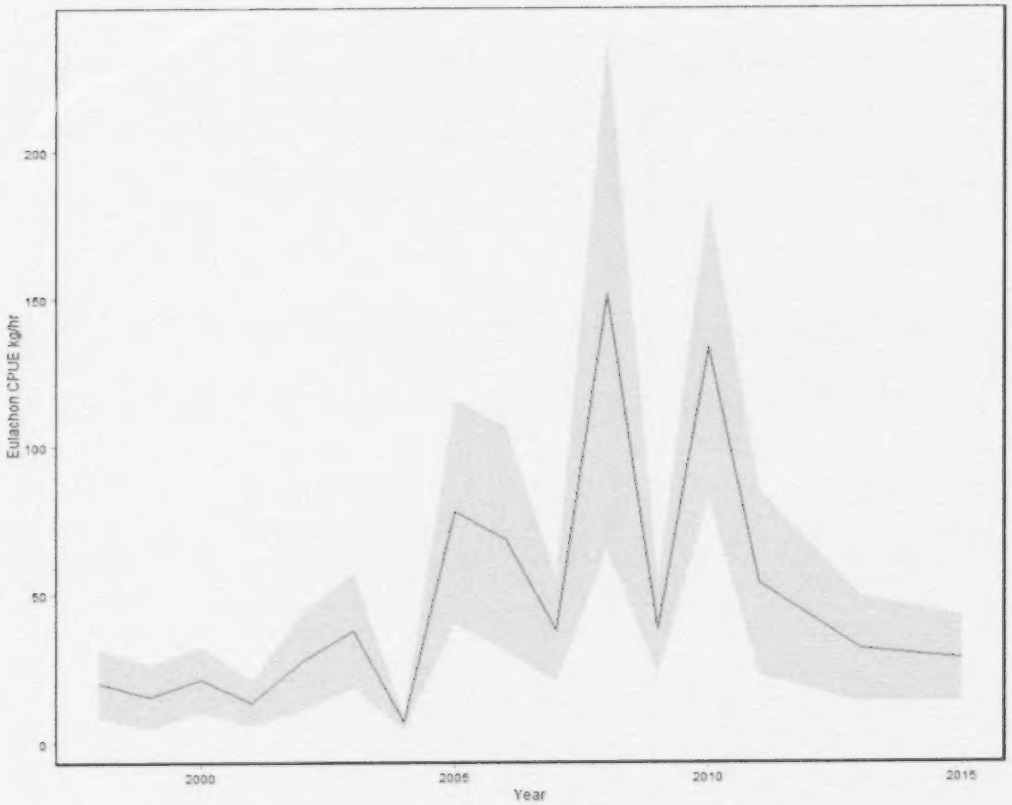

Figure 4. Catch per unit effort (kg/hr) of Eulachon from the Chatham Sound shrimp trawl surveys. Red line is the mean with gray ribbon being the 95% confidence intervals.

Table 3. Assigned stock proportion across all samples

Region	Probability	SD
Fraser	0.6	(1.8)
Central coast	45.6	(12.6)
Nass/Skeena	45.6	(12.5)
Columbia	8.2	(5.7)

DISCUSSION

Multi-species surveys are valuable tools for a variety of reasons and provide important baseline information, or more importantly, a time series of information that help understand changes in the oceans. The Chatham Sound shrimp trawl survey incidentally catches Eulachon that originate primarily from the Skeena and Nass Rivers. Catch per unit effort (CPUE) can be used as a tool to monitor trends as a relative index of abundance. Although there is large variability in the estimate, the 2015 Eulachon CPUE appears slightly higher than the earlier years of the time series, but well below the peak of 2009 and 2011 (Figure 4). Given that Eulachon are a short lived species (3+years) large fluctuations in population dynamics aren't unexpected but reinforces the need for consistent long-term monitoring.

Eulachon have proven to be difficult to age reliably and length frequency analysis is used as proxy for the determination of age classes. As with CPUE, there is strong variability between years but, as with other Eulachon populations, a bi-modal distribution is observed, suggesting two age classes are consistently detected in the trawl survey (Figure 2). Although the survey has been conducted since 1998, collection of biological information (length, weight, tissues samples) on Eulachon was ended in 2002. Fortunately catch records were kept for the entire time series that enables the comparison of the 2015 length frequency data to the previous time series (Figure 5).

Chatham Sound appears to not only be a staging area for larger fish in the fall but may also be important for young of the year and age 1+ for foraging and rearing. From the length frequency analysis of the 200 fish collected and returned to the Pacific Biological Station it would appear that there is a third age class (0+) is present (Figure 3). The relatively large proportion of smaller fish in Figure 3 should be noted with caution as the proportion is biased by the non-random sampling method. Only the smaller fish (<50 mm) that could be identified as Eulachon were included in the length-frequency analysis.

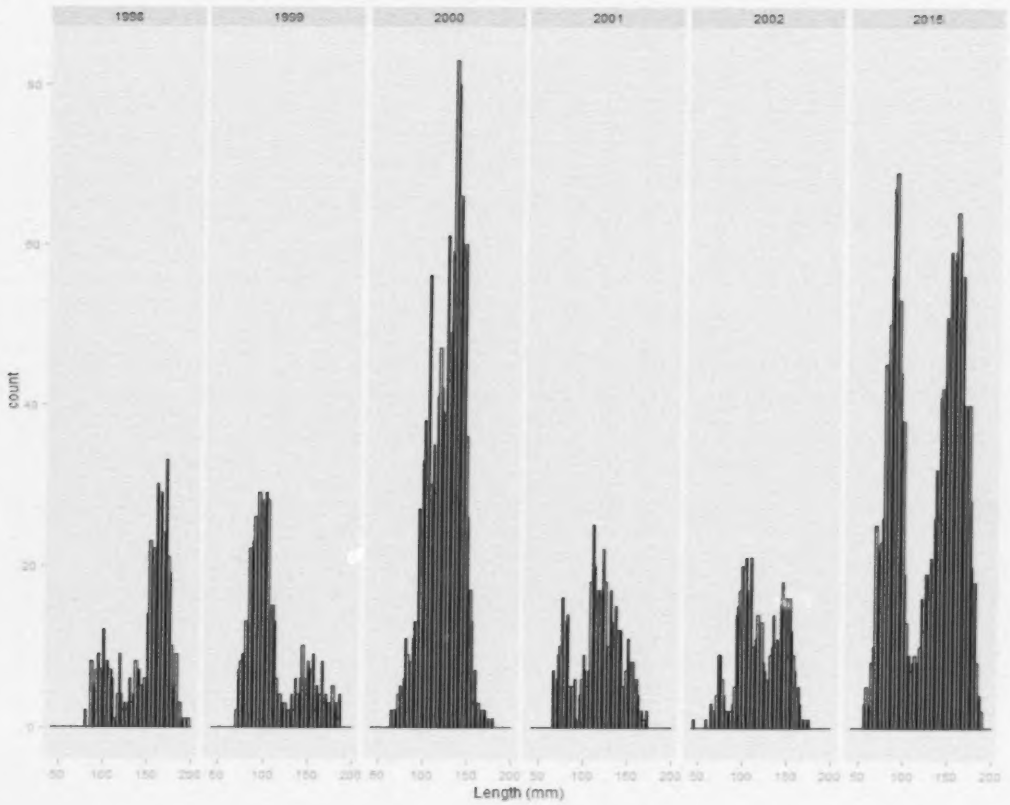

Figure 5. Eulachon length-frequency graph by year from the Chatham Sound shrimp trawl survey.

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APPENDIX 1

Table 4. Population assignment by sample with associated probabilities.

Fish ID	Region	Probability	Region	Probability	Region	Probability	Region	Probability
501	Nass/Skeena	0.77	Central Coast	0.12	Columbia	0.07	Fraser	0.03
502	Central Coast	0.58	Nass/Skeena	0.34	Columbia	0.08	Fraser	0.00
503	Nass/Skeena	0.56	Central Coast	0.42	Columbia	0.02	Fraser	0.00
504	Central Coast	0.54	Nass/Skeena	0.43	Columbia	0.03	Fraser	0.00
505	Central Coast	0.53	Columbia	0.23	Nass/Skeena	0.23	Fraser	0.00
506	Central Coast	0.60	Nass/Skeena	0.36	Columbia	0.04	Fraser	0.00
507	Nass/Skeena	0.95	Central Coast	0.04	Columbia	0.01	Fraser	0.00
508	Central Coast	0.54	Nass/Skeena	0.41	Columbia	0.05	Fraser	0.00
509	Central Coast	0.59	Nass/Skeena	0.40	Columbia	0.01	Fraser	0.00
510	Central Coast	0.54	Nass/Skeena	0.34	Columbia	0.12	Fraser	0.00
511	Nass/Skeena	0.86	Columbia	0.09	Central Coast	0.05	Fraser	0.00
512	Central Coast	0.73	Nass/Skeena	0.27	Columbia	0.01	Fraser	0.00
513	Nass/Skeena	0.77	Central Coast	0.17	Columbia	0.06	Fraser	0.00
514	Central Coast	0.52	Nass/Skeena	0.47	Columbia	0.01	Fraser	0.00
515	Nass/Skeena	0.51	Central Coast	0.35	Columbia	0.13	Fraser	0.01
516	Nass/Skeena	0.51	Central Coast	0.47	Columbia	0.01	Fraser	0.00
517	Nass/Skeena	0.63	Central Coast	0.26	Columbia	0.11	Fraser	0.01
518	Central Coast	0.83	Nass/Skeena	0.14	Columbia	0.03	Fraser	0.00
519	Nass/Skeena	0.55	Central Coast	0.43	Columbia	0.02	Fraser	0.00
520	Central Coast	0.49	Nass/Skeena	0.34	Columbia	0.15	Fraser	0.02
521	Central Coast	0.67	Nass/Skeena	0.19	Columbia	0.13	Fraser	0.00
522	Central Coast	0.62	Nass/Skeena	0.36	Columbia	0.02	Fraser	0.00
523	Central Coast	0.64	Nass/Skeena	0.30	Columbia	0.05	Fraser	0.00
524	Nass/Skeena	0.56	Central Coast	0.41	Columbia	0.03	Fraser	0.00

525	Nass/Skeena	0.54	Central Coast	0.39	Columbia	0.06	Fraser	0.00
526	Central Coast	0.48	Nass/Skeena	0.26	Columbia	0.26	Fraser	0.01
527	Nass/Skeena	0.56	Central Coast	0.36	Columbia	0.07	Fraser	0.01
528	Nass/Skeena	0.49	Central Coast	0.47	Columbia	0.04	Fraser	0.00
529	Central Coast	0.46	Nass/Skeena	0.45	Columbia	0.07	Fraser	0.01
530	Central Coast	0.74	Nass/Skeena	0.19	Columbia	0.07	Fraser	0.01
531	Nass/Skeena	0.82	Central Coast	0.17	Columbia	0.01	Fraser	0.00
532	Nass/Skeena	0.63	Central Coast	0.30	Columbia	0.06	Fraser	0.00
533	Central Coast	0.55	Nass/Skeena	0.40	Columbia	0.05	Fraser	0.00
534	Nass/Skeena	0.57	Central Coast	0.41	Columbia	0.01	Fraser	0.00
535	Nass/Skeena	0.64	Central Coast	0.33	Columbia	0.03	Fraser	0.00
536	Columbia	0.43	Central Coast	0.33	Nass/Skeena	0.22	Fraser	0.02
537	Central Coast	0.37	Columbia	0.33	Nass/Skeena	0.29	Fraser	0.01
538	Nass/Skeena	0.56	Central Coast	0.25	Columbia	0.17	Fraser	0.02
539	Nass/Skeena	0.51	Central Coast	0.46	Columbia	0.02	Fraser	0.00
540	Nass/Skeena	0.47	Central Coast	0.44	Columbia	0.08	Fraser	0.00
541	Central Coast	0.64	Nass/Skeena	0.35	Columbia	0.01	Fraser	0.01
542	Nass/Skeena	0.56	Central Coast	0.41	Columbia	0.02	Fraser	0.01
543	Nass/Skeena	0.49	Central Coast	0.40	Columbia	0.10	Fraser	0.00
544	Central Coast	0.57	Nass/Skeena	0.42	Columbia	0.01	Fraser	0.00
545	Nass/Skeena	0.68	Central Coast	0.32	Columbia	0.01	Fraser	0.00
546	Central Coast	0.51	Nass/Skeena	0.38	Columbia	0.09	Fraser	0.02
547	Nass/Skeena	0.60	Central Coast	0.37	Columbia	0.03	Fraser	0.00
548	Central Coast	0.49	Nass/Skeena	0.45	Columbia	0.05	Fraser	0.00
549	Nass/Skeena	0.63	Central Coast	0.31	Columbia	0.06	Fraser	0.01
550	Central Coast	0.58	Nass/Skeena	0.39	Columbia	0.03	Fraser	0.00
551	Central Coast	0.56	Nass/Skeena	0.42	Columbia	0.02	Fraser	0.00
552	Nass/Skeena	0.47	Columbia	0.31	Central Coast	0.20	Fraser	0.01
553	Central Coast	0.63	Nass/Skeena	0.36	Columbia	0.01	Fraser	0.00

554	Nass/Skeena	0.43	Columbia	0.29	Central Coast	0.27	Fraser	0.01
555	Central Coast	0.47	Nass/Skeena	0.47	Columbia	0.05	Fraser	0.00
556	Nass/Skeena	0.56	Central Coast	0.39	Columbia	0.05	Fraser	0.00
557	Central Coast	0.61	Nass/Skeena	0.37	Columbia	0.02	Fraser	0.00
558	Nass/Skeena	0.91	Central Coast	0.08	Columbia	0.01	Fraser	0.00
559	Nass/Skeena	0.57	Central Coast	0.42	Columbia	0.01	Fraser	0.00
560	Central Coast	0.51	Nass/Skeena	0.42	Columbia	0.06	Fraser	0.00
561	Nass/Skeena	0.56	Central Coast	0.39	Columbia	0.05	Fraser	0.00
562	Nass/Skeena	0.52	Central Coast	0.47	Columbia	0.01	Fraser	0.00
563	Central Coast	0.67	Nass/Skeena	0.29	Columbia	0.03	Fraser	0.01
564	Nass/Skeena	0.58	Central Coast	0.40	Columbia	0.02	Fraser	0.00
565	Central Coast	0.49	Nass/Skeena	0.47	Columbia	0.04	Fraser	0.00
566	Columbia	0.61	Central Coast	0.21	Nass/Skeena	0.18	Fraser	0.00
567	Central Coast	0.78	Nass/Skeena	0.16	Columbia	0.06	Fraser	0.00
568	Central Coast	0.59	Nass/Skeena	0.37	Columbia	0.03	Fraser	0.00
569	Nass/Skeena	0.47	Central Coast	0.46	Columbia	0.06	Fraser	0.00
570	Nass/Skeena	0.73	Central Coast	0.26	Columbia	0.01	Fraser	0.00
571	Central Coast	0.53	Nass/Skeena	0.33	Columbia	0.10	Fraser	0.04
572	Nass/Skeena	0.50	Central Coast	0.49	Columbia	0.01	Fraser	0.00
573	Central Coast	0.52	Nass/Skeena	0.43	Columbia	0.04	Fraser	0.00
574	Columbia	0.57	Central Coast	0.21	Nass/Skeena	0.20	Fraser	0.02
575	Nass/Skeena	0.85	Central Coast	0.14	Columbia	0.01	Fraser	0.00
576	Nass/Skeena	0.43	Columbia	0.33	Central Coast	0.23	Fraser	0.01
577	Nass/Skeena	0.54	Central Coast	0.44	Columbia	0.02	Fraser	0.00
578	Central Coast	0.58	Nass/Skeena	0.40	Columbia	0.02	Fraser	0.00
579	Nass/Skeena	0.46	Central Coast	0.34	Columbia	0.19	Fraser	0.01
580	Columbia	0.43	Nass/Skeena	0.28	Central Coast	0.27	Fraser	0.02
581	Nass/Skeena	0.84	Central Coast	0.08	Columbia	0.06	Fraser	0.02
582	Central Coast	0.50	Nass/Skeena	0.48	Columbia	0.02	Fraser	0.00

583	Nass/Skeena	0.65	Central Coast	0.32	Columbia	0.03	Fraser	0.00
584	Central Coast	0.88	Nass/Skeena	0.09	Columbia	0.03	Fraser	0.00
585	Central Coast	0.50	Nass/Skeena	0.37	Columbia	0.11	Fraser	0.01
586	Central Coast	0.54	Nass/Skeena	0.43	Columbia	0.03	Fraser	0.00
587	Central Coast	0.72	Nass/Skeena	0.24	Columbia	0.04	Fraser	0.00
588	Nass/Skeena	0.44	Central Coast	0.44	Columbia	0.11	Fraser	0.01
589	Nass/Skeena	0.66	Central Coast	0.33	Columbia	0.01	Fraser	0.00
590	Nass/Skeena	0.52	Central Coast	0.46	Columbia	0.01	Fraser	0.00
591	Central Coast	0.40	Nass/Skeena	0.39	Columbia	0.20	Fraser	0.00
592	Nass/Skeena	0.58	Central Coast	0.39	Columbia	0.03	Fraser	0.00
593	Central Coast	0.77	Nass/Skeena	0.16	Columbia	0.05	Fraser	0.02
594	Nass/Skeena	0.88	Central Coast	0.11	Columbia	0.01	FALSE	
595	Central Coast	0.74	Columbia	0.14	Nass/Skeena	0.12	Fraser	0.01
601	Central Coast	0.61	Nass/Skeena	0.31	Columbia	0.08	Fraser	0.00
602	Central Coast	0.70	Nass/Skeena	0.28	Columbia	0.01	Fraser	0.00
603	Nass/Skeena	0.60	Central Coast	0.39	Columbia	0.01	Fraser	0.00
604	Central Coast	0.66	Nass/Skeena	0.22	Columbia	0.08	Fraser	0.03
605	Central Coast	0.47	Nass/Skeena	0.47	Columbia	0.06	Fraser	0.00
606	Nass/Skeena	0.98	Central Coast	0.02	Columbia	0.00	Fraser	0.00
607	Central Coast	0.61	Nass/Skeena	0.24	Fraser	0.09	Columbia	0.06
608	Central Coast	0.62	Nass/Skeena	0.36	Columbia	0.01	Fraser	0.00
609	Nass/Skeena	0.50	Central Coast	0.42	Columbia	0.07	Fraser	0.00
610	Central Coast	0.59	Nass/Skeena	0.25	Columbia	0.14	Fraser	0.02
611	Nass/Skeena	0.78	Central Coast	0.22	Columbia	0.00	Fraser	0.00
612	Central Coast	0.74	Nass/Skeena	0.19	Columbia	0.06	Fraser	0.00
613	Central Coast	0.68	Nass/Skeena	0.29	Columbia	0.02	Fraser	0.01
614	Central Coast	0.62	Nass/Skeena	0.37	Columbia	0.01	Fraser	0.00
615	Nass/Skeena	0.49	Central Coast	0.49	Columbia	0.02	Fraser	0.00
616	Central Coast	0.66	Nass/Skeena	0.25	Columbia	0.09	Fraser	0.01

617	Central Coast	0.64	Nass/Skeena	0.35	Columbia	0.00	Fraser	0.00
618	Nass/Skeena	0.50	Central Coast	0.36	Columbia	0.13	Fraser	0.02
619	Central Coast	0.52	Nass/Skeena	0.32	Columbia	0.15	Fraser	0.01
620	Nass/Skeena	0.63	Central Coast	0.32	Columbia	0.05	Fraser	0.00
621	Nass/Skeena	0.85	Central Coast	0.14	Columbia	0.00	Fraser	0.00
622	Nass/Skeena	0.77	Central Coast	0.19	Columbia	0.04	Fraser	0.01
623	Central Coast	0.63	Nass/Skeena	0.22	Columbia	0.14	Fraser	0.01
624	Nass/Skeena	0.97	Central Coast	0.03	Columbia	0.01	Fraser	0.00
625	Central Coast	0.57	Nass/Skeena	0.37	Columbia	0.06	Fraser	0.00
626	Central Coast	0.81	Nass/Skeena	0.18	Columbia	0.01	Fraser	0.00
627	Nass/Skeena	0.57	Central Coast	0.42	Columbia	0.01	Fraser	0.00
628	Central Coast	0.49	Nass/Skeena	0.47	Columbia	0.04	Fraser	0.00
629	Nass/Skeena	0.50	Central Coast	0.45	Columbia	0.05	Fraser	0.00
630	Nass/Skeena	0.52	Central Coast	0.47	Columbia	0.01	Fraser	0.00
631	Central Coast	0.49	Nass/Skeena	0.39	Columbia	0.11	Fraser	0.00
632	Nass/Skeena	0.51	Central Coast	0.41	Columbia	0.08	Fraser	0.00
633	Central Coast	0.42	Nass/Skeena	0.39	Columbia	0.18	Fraser	0.01
634	Central Coast	0.45	Nass/Skeena	0.37	Columbia	0.17	Fraser	0.00
635	Nass/Skeena	0.50	Central Coast	0.44	Columbia	0.05	Fraser	0.01
636	Nass/Skeena	0.46	Central Coast	0.41	Columbia	0.11	Fraser	0.01
637	Nass/Skeena	0.51	Central Coast	0.39	Columbia	0.10	Fraser	0.01
638	Nass/Skeena	0.45	Central Coast	0.40	Columbia	0.14	Fraser	0.00
639	Nass/Skeena	0.54	Central Coast	0.38	Columbia	0.07	Fraser	0.01
640	Nass/Skeena	0.60	Central Coast	0.31	Columbia	0.08	Fraser	0.01
641	Central Coast	0.58	Nass/Skeena	0.41	Columbia	0.01	Fraser	0.00
642	Central Coast	0.66	Nass/Skeena	0.32	Columbia	0.01	Fraser	0.00
643	Nass/Skeena	0.52	Central Coast	0.47	Columbia	0.01	Fraser	0.00
644	Nass/Skeena	0.50	Central Coast	0.44	Columbia	0.06	Fraser	0.00
645	Central Coast	0.64	Nass/Skeena	0.33	Columbia	0.03	Fraser	0.00

646	Central Coast	0.50	Nass/Skeena	0.33	Columbia	0.15	Fraser	0.03
647	Nass/Skeena	0.52	Central Coast	0.38	Columbia	0.09	Fraser	0.00
648	Nass/Skeena	0.82	Central Coast	0.15	Columbia	0.02	Fraser	0.01
649	Columbia	0.37	Central Coast	0.35	Nass/Skeena	0.26	Fraser	0.01
650	Central Coast	0.48	Nass/Skeena	0.46	Columbia	0.06	Fraser	0.00
651	Nass/Skeena	0.60	Central Coast	0.37	Columbia	0.02	Fraser	0.01
652	Central Coast	0.44	Nass/Skeena	0.34	Columbia	0.21	Fraser	0.01
653	Central Coast	0.51	Nass/Skeena	0.38	Columbia	0.10	Fraser	0.01
654	Nass/Skeena	0.58	Central Coast	0.37	Columbia	0.04	Fraser	0.00
655	Nass/Skeena	0.60	Central Coast	0.39	Columbia	0.01	Fraser	0.00
656	Central Coast	0.55	Nass/Skeena	0.41	Columbia	0.05	Fraser	0.00
657	Central Coast	0.61	Nass/Skeena	0.32	Columbia	0.06	Fraser	0.00
658	Columbia	0.80	Central Coast	0.10	Nass/Skeena	0.09	Fraser	0.01
659	Nass/Skeena	0.53	Central Coast	0.46	Columbia	0.01	Fraser	0.00
660	Nass/Skeena	0.46	Central Coast	0.43	Columbia	0.11	Fraser	0.00
661	Central Coast	0.63	Nass/Skeena	0.35	Columbia	0.02	Fraser	0.00
662	Nass/Skeena	0.61	Central Coast	0.28	Columbia	0.10	Fraser	0.00
663	Nass/Skeena	0.68	Central Coast	0.29	Columbia	0.03	Fraser	0.00
664	Central Coast	0.53	Nass/Skeena	0.45	Columbia	0.02	Fraser	0.00
665	Central Coast	0.58	Nass/Skeena	0.25	Columbia	0.15	Fraser	0.02
666	Nass/Skeena	0.69	Columbia	0.17	Central Coast	0.12	Fraser	0.02
667	Nass/Skeena	0.44	Central Coast	0.33	Columbia	0.22	Fraser	0.02
668	Central Coast	0.62	Nass/Skeena	0.27	Columbia	0.10	Fraser	0.02
669	Central Coast	0.50	Nass/Skeena	0.45	Columbia	0.04	Fraser	0.00
670	Central Coast	0.59	Nass/Skeena	0.27	Columbia	0.14	Fraser	0.00
671	Central Coast	0.65	Nass/Skeena	0.27	Columbia	0.07	Fraser	0.02
672	Central Coast	0.50	Nass/Skeena	0.48	Columbia	0.02	Fraser	0.00
673	Nass/Skeena	0.58	Central Coast	0.33	Columbia	0.09	Fraser	0.00
674	Central Coast	0.63	Nass/Skeena	0.28	Columbia	0.09	Fraser	0.01

675	Central Coast	0.64	Nass/Skeena	0.27	Columbia	0.08	Fraser	0.02
676	Nass/Skeena	0.50	Central Coast	0.40	Columbia	0.10	Fraser	0.01
677	Central Coast	0.66	Nass/Skeena	0.31	Columbia	0.02	Fraser	0.01
678	Central Coast	0.67	Nass/Skeena	0.26	Columbia	0.07	Fraser	0.00
679	Central Coast	0.73	Columbia	0.13	Nass/Skeena	0.13	Fraser	0.01
680	Nass/Skeena	0.54	Central Coast	0.37	Columbia	0.07	Fraser	0.02
681	Central Coast	0.69	Nass/Skeena	0.30	Columbia	0.01	Fraser	0.00
682	Nass/Skeena	0.52	Central Coast	0.29	Columbia	0.17	Fraser	0.01
683	Nass/Skeena	0.61	Central Coast	0.37	Columbia	0.01	Fraser	0.00
684	Nass/Skeena	0.37	Central Coast	0.32	Columbia	0.29	Fraser	0.03
685	Central Coast	0.54	Nass/Skeena	0.43	Columbia	0.02	Fraser	0.01
686	Central Coast	0.56	Nass/Skeena	0.40	Columbia	0.03	Fraser	0.01
687	Nass/Skeena	0.49	Central Coast	0.46	Columbia	0.05	Fraser	0.00
688	Nass/Skeena	0.65	Central Coast	0.34	Columbia	0.01	FALSE	
689	Central Coast	0.52	Nass/Skeena	0.46	Columbia	0.02	Fraser	0.00
690	Central Coast	0.50	Nass/Skeena	0.44	Columbia	0.05	Fraser	0.01
691	Central Coast	0.47	Nass/Skeena	0.29	Columbia	0.24	Fraser	0.01
692	Central Coast	0.61	Nass/Skeena	0.38	Columbia	0.01	Fraser	0.00
693	Nass/Skeena	0.79	Central Coast	0.19	Columbia	0.02	Fraser	0.00
694	Central Coast	0.61	Nass/Skeena	0.30	Columbia	0.08	Fraser	0.01
695	Central Coast	0.46	Nass/Skeena	0.46	Columbia	0.08	Fraser	0.01